Botttleneck Information and Reduction: An Analysis of the Logistics Reparable Pipeline

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Introduction

This article presents the analysis of select avionics line replaceable units (LRUs) from the F-16 weapon system and centers on depot-sourced Not Mission Capable Supply (NMCS) parts shipments. Lateral supply support was not considered in the analysis. The goal was to identify the specific location of bottlenecks within the logistics reparable pipeline (LRP) and offer recommendations that may reduce or eliminate them.

Analysis identified 641 shipments that exceeded the allowable Uniform Material Movement and Issue Priority System (UMMIPS) time standard. This is an 83.45 percent failure rate.

A total of 768 NMCS, DD Form 1348-1A Issue Release-Receipt Documents (IRRD), were retrieved from the Enhanced Transportation Automated Data System (ETADS). Analysis identified 641 shipments that exceeded the allowable Uniform Material Movement and Issue Priority System (UMMIPS) time standard. This is an 83.45 percent failure rate.

Focusing on F-16 avionics LRUs was not by chance. The top five problem parts, according to the then PACER LEAN project office, were selected for this study.[1] PACER LEAN, at the time was Headquarters Air Force Materiel Command's (HQ AFMC) test program to verify whether the Depot Repair Enhancement Process and Contract Repair Enhancement Program were working as planned. Problem parts are defined as those parts shipments that continually exceed UMMIPS standards. UMMIPS standards are used throughout the DoD and are set forth in *DoD 4140.1-R*. UMMIPS recognizes the priorities used by both transportation and supply.

Data Methodology and Collection

Key questions that drove this study were:

- Do bottlenecks exist within the LRP? If so, where are they and what is the cause?
- How can bottlenecks be reduced or eliminated?

To determine whether bottlenecks exist within the LRP, HQ AFMC/LGTR provided NMCS shipment data from the ETADS. The data set was compared to the UMMIPS standard to verify if shipments met the standard. Only the shipments that exceeded the standard were analyzed. Additionally, each IRRD was physically obtained and reviewed for accurate receipt date information. Each IRRD was separated and evaluated by the following: overseas or Continental United States (CONUS) location, theater of operation, base, supply requisition account number (SRAN) and national stock number (NSN). The AO (customer request), AS (shipment status), D6S (customer receipt) times from the ETADS data, receipt and process dates from each IRRD and Federal Express (FedEx) delivery receipts were used for comparison with the UMMIPS standard.

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In order to accurately identify bottlenecks within any system or process, an accurate measurement of total time spent in that system must be compared to the system standard. The LRP time begins when a reparable LRU is requisitioned and ends when the customer receives the part. A major assumption used in this study was that customer receipt occurred the same day as supply receipt. This assumption is based on the premise that NMCS parts are inherently high visibility assets and an audit trail is required. To evaluate the pipeline performance, the shipment times were compared to the UMMIPS standard. An NMCS part is allowed from seven to 17 days in-transit time, from requisition to customer receipt depending upon the theater of operation. The LRP is divided into the following segments: Requisition (AO), Item Availability (AE), Shipment Status (AS) and Receipt (D6S).

Data division into separate tiers is essential to identify bottlenecks because these divisions help to identify whether bottlenecks occur Air Force-wide, theater-wide or simply at one or more locations.

The first tier evaluation of the 768 shipments found 86 from overseas locations and the remaining 682 were consigned to active or reserve Air Force units throughout the CONUS.

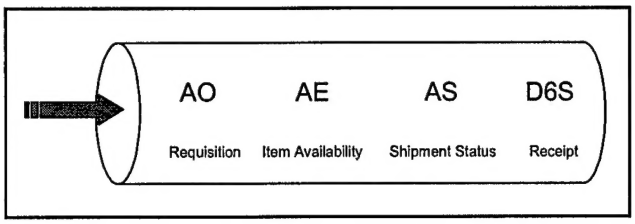

Figure 1. Logistics Pipeline

The shipment information was then divided into overseas or CONUS location by SRAN and DoDAAC (Department of Defense Activity Address Code). The transit time for the 768 shipments was compared with the UMMIPS standard and 641 shipments, 83.5 percent, failed to meet the required standard. Of the 682 CONUS shipments, only 83 met the UMMIPS standard. The remaining 599 shipments exceeded the standard—an 88 percent failure rate.

The second tier evaluation involved the 86 overseas shipments. Only 19 of these 86 shipments met the UMMIPS standard, which equates to 78 percent exceeding the standard. Only two overseas bases, Kunsan AB, Republic of Korea, and Elmendorf AFB, Alaska, met the standard consistently. The reason for this may be due to the intra-theater intermediate depot level repair facility located in Japan which allows Kunsan AB and Elmendorf AFB to have reparable parts repaired and returned more expediently and thus have a faster turnaround time than would be experienced from repair service at a major depot in the CONUS. However, the most significant change is the reduction in transit time. On average, it takes one to three days transit time within the Pacific Air Forces region. This time would dramatically increase if parts had to be shipped to a CONUS facility because of the additional transportation requirements.

The final information needed for this study was the actual customer receipt dates found in the D6S report from base supply. This included identifying the consignee (receiving base) and requesting another IRRD to verify the date of receipt at base supply. For the data collection, only 42 actual documents were received from the base supply document control sections. These documents were examined to verify the actual receipt date by the base supply representative. In most cases the receipt signature was from a commercial carrier representative.

The final step was to evaluate the data by pipeline segment. This was done by extracting the dates from the various data sources and placing them in order of occurrence in the pipeline. The dates were compared by segment with the UMMIPS standard. If the shipment time is one or more days greater than the standard within any one segment, this constitutes a bottleneck.

Results and Analysis

Do bottlenecks exist within the LRP? If so, where are they and what are the causes? Internal bottlenecks and external paperwork delays exist with respect to the LRP.

Do Bottlenecks Exist Within the LRP? If So, Where Are They and What Are the Causes?

Internal bottlenecks and external paperwork delays exist with respect to the LRP. External paperwork delays occur at the base supply receiving section as a result of batch processing. These paperwork delays cause a misrepresentation of the data. It is *highly likely* that a NMCS part is already aboard an aircraft and bound for the consignee. However, batch processing data several days later into the Standard Base Supply System (SBSS) will indicate a longer base supply handling and processing time when in actuality the part is moving through the system in a timely manner.

This study found that FedEx delivered 19 of the 100 randomly selected shipments to the consignees. These 19 shipments reflect the number of shipments that have FedEx data assigned to them in the ETADS, the data source for FedEx shipments. The shipments were in-checked by the receiving section the following business day after being tendered to FedEx. The ETADS data and IRRDs were used to evaluate FedEx's performance. This was done by identifying the date each shipment was tendered to FedEx and by identifying the date each shipment was received at the destination supply's receiving section. The signature date on the IRRD identified whether the documents were batch processed at the receiving section, resulting in an inaccurate reflection of the actual receipt date. If the shipment receipt date annotated on the IRRD is earlier than the Julian date entered into the SBSS, this indicates the documents were received by base supply and then processed some time after the actual receipt date. Only five of

Most Significant Article Award

The Editorial Advisory Board selected "Fightn' N' Stuff," written by Wing Commander David J. Foster, RAF, as the most significant article in the Volume XXII, Number 3 issue of the *Air Force Journal of Logistics*.

the 100 randomly selected shipments were requisitioned using the SBSS method, while the remaining 95 shipments were requisitioned via telephone. The telephonic requisitioning method may offer the customer an expedited requisition when compared to the standard method, but the downside to this method is the loss of control by base supply in the requisitioning process.

Only 63 of the 100 IRRDs were received. This response rate was due to factors such as inadequate quality assurance, lost data or illegible documents. Several bases contacted could not provide any documentation due to faulty computer disc storage.

The overall UMMIPS performance for overseas and CONUS shipments is shown in Figure 2. The data evidence that

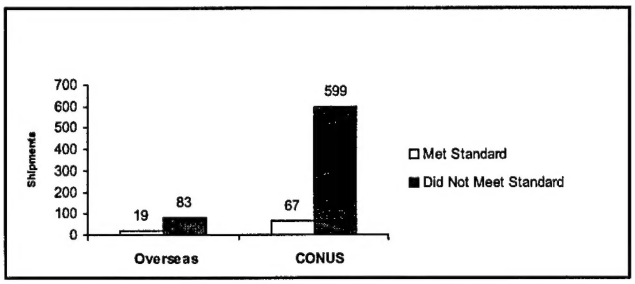

Figure 2. Overall CONUS and Overseas UMMIPS Performance

bottlenecks exist within the LRP.

Figure 3 presents the overall UMMIPS performance for overseas shipments by theater. Over 65 percent of the total shipments in each theater exceeded the standard.

Figure 4 presents the random overseas shipments with the respective UMMIPS performance by theater. The data clearly

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indicate bottlenecks in the LRP in at least three of the four theaters. The Alaskan Air Command did not have any randomly selected shipments evaluated.

Figure 5 presents the randomly selected CONUS shipments and respective UMMIPS performance. Approximately 44 percent of the shipments met the standard, thus confirming some forms of bottlenecks within the CONUS theater.

The data set in Figure 6 indicates that bottlenecks exist within the pipeline at various segments. However, the most prominent location is the AS segment with 49 shipments exceeding the standard. Data analysis consists of 63 shipments with accompanying IRRD. The total number of bottlenecks is 90 with 49 shipments in the AS segment, 23 shipments in the AE segment and 18 combined shipments (more than one bottleneck per shipment).

According to the UMMIPS standard, a CONUS shipment is allowed 1.5 days to pass through the requisitioning process

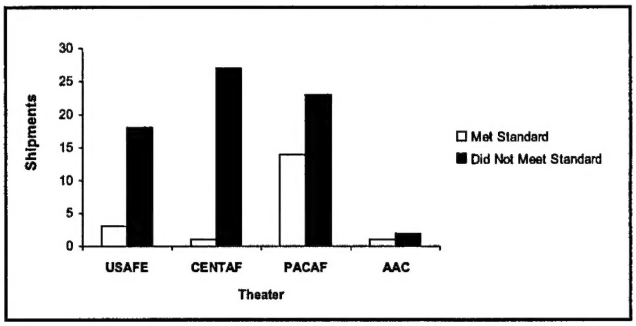

Figure 3. Overall Overseas UMMIPS Performance

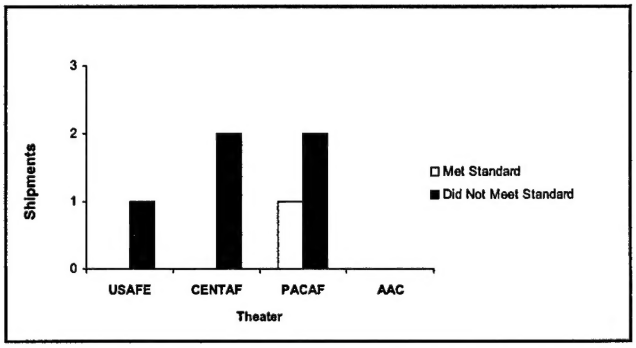

Figure 4. Random Overseas UMMIPS Performance

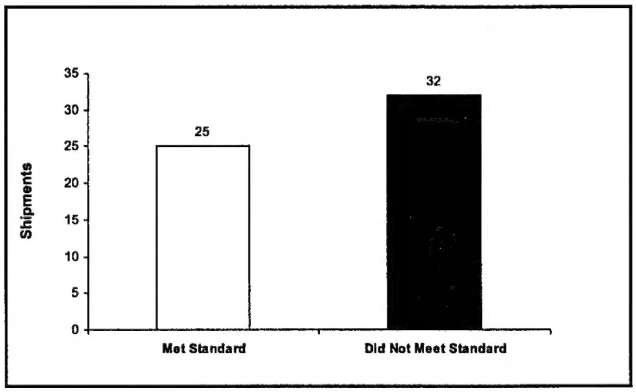

Figure 5. Random CONUS UMMIPS Performance

(AO). The time period begins when the customer requisitions a part. A majority of requisitions are performed via telephonic means, creating a problem determining exactly when the actual requisition occurred.

The original data set included over 768 shipments and only 94 shipments had AO codes assigned. The 63 randomly selected shipment forms were evaluated using the ETADS data and compared with the actual IRRD to identify the requisition date. The data show no shipments exceeding the UMMIPS standard for the AO portion. Within the data collection limits, this supports the conclusion that no bottlenecks exist within this segment of the LRP.

The data in Figure 7 indicate a backorder caused the bottleneck for approximately 60 percent of the shipments.

The evaluation identified 22 shipments exceeding the standard. A more in-depth inspection showed a majority of the delays were caused by an inadequate parts supply. Thirteen of the 22 shipments were backordered (BB) and nine shipment

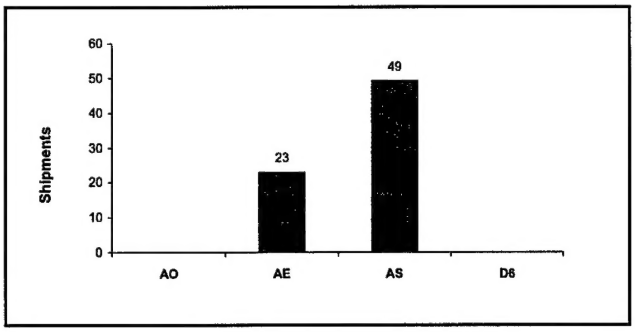

Figure 6. Pipeline Segment Bottlenecks

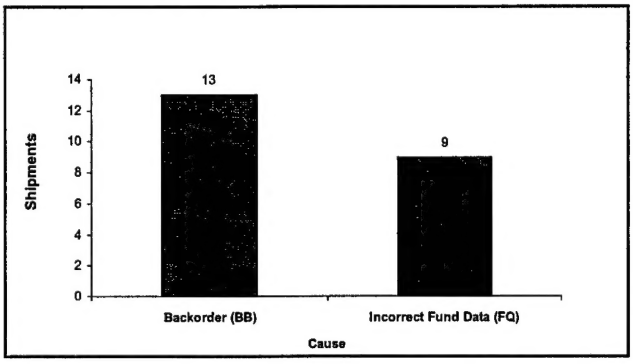

Figure 7. AE Bottleneck Causes

delays were due to a new funding code requirement (FQ).

With regard to the shipment status, AS, of the 63 shipments mentioned above, the data explicitly identify 49 shipments exceeding the UMMIPS standard of one day for CONUS movement and five days for overseas movement. Also, by evaluating each IRRD, Airway Bill or Government Bill of Lading, 27 shipments were shipped over a weekend and 19 shipments were sent second-day air because the government contract carrier does not offer Saturday delivery for cargo weighing more than 150 pounds. The remaining eight of the 27 weekend shipments could have been delivered on Saturday; however, the transportation office must pay a higher price for this service. The remaining 22 shipments were shipped on Monday, Tuesday or Wednesday, with an average in-transit time of 25 days.

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The actual shipping documents and data retrieved from the Visual Logistics Information Processing System (VLIPS) show that some parts were actually shipped under a different transportation priority than what the shipping document indicated. Another cause for the excessive in-transit time was due to the shipment traveling under Mode B, less than truckload (LTL), which takes from seven to 10 days for delivery. Sending an NMCS item by any mode other than next day air will result in a shipment exceeding the UMMIPS standard for the CONUS portion of the shipment.

The D6S receipt segment of the bottleneck was evaluated in the same manner as the AO, AE and AS segments. The shipping documents revealed eight of the 63 shipments were received prior to the date listed in ETADS. Six of the 63 IRRDs received had signed base supply receipt dates by the consignee that were several days earlier than the receipt dates reported by ETADS. The discrepancy in dates leads to the conclusion that upon receipt by base supply, the receiving unit picked up the item or supply delivered the item to the unit. Then, after the customer signed for the item, the IRRD was batch processed several days later into the SBSS. Document batch processing is more likely to occur when Saturday or Sunday is within one day of the date of actual item receipt. Six of the 63 shipments were received an average of five days prior to being processed into the SBSS. This information was taken directly from each IRRD. The actual receipts are more accurate. Shipment receipt dates entered into the SBSS using a batch process causes inaccurate reporting of receipt dates and leads to a misrepresentation of the true performance of the LRP.

Reducing or Eliminating Bottlenecks

All domestic (CONUS, Alaska, Hawaii, Puerto Rico) priority overnight/two-day air express shipments between eight ounces and 150 pounds and up to 119 inches in length or 165 inches in length and girth combined, must be moved using services and rates available through the GSA Small Package Contract. The only exceptions are: shipments of 500 miles or less; shipments made under existing contracts or guaranteed traffic agreements; when required by wartime or contingency operations; and shipments outside the scope of the contract.

In light of the items considered in this research, an obvious solution to the bottlenecks observed is to pay for and generally always use next-day air delivery or Saturday delivery versus two-day delivery. Two reasons argue for this: first, two-day delivery will not meet UMMIPS and second, the difference in cost is insignificant. For example, FedEx charges $224 for next-day deliver and $172 for two-day deliver for shipments with a gross weight of 150 pounds or more.[2] However, since the unit bears the cost of these shipments, a practical decision for the unit may in fact exist during periods of flat or declining budgets. There may in fact be tradeoffs between the bottlenecks in the system, length of time to return an aircraft to mission capable status and the costs associated with next-day delivery.

Increasing the level of on-hand supply to prevent backorders could relieve bottlenecks within the availability (AE) segment of the pipeline. The level of additional spares required was not examined in this study, nor were particular stockage polices or procedures investigated.

Document batch processing is probably the easiest problem to correct. Batch processing is a *free-fix* because the problem can be resolved without the need for additional funding. One solution is to implement a policy that requires the receipt of all shipments to be immediately entered into the SBSS. This action

(Continued on top of page 42)

should prevent inaccurate data reporting and enhance the decision-making process of all agencies involved.

The importance of accurately reporting data can not be underestimated. Incorrect receipt dates could adversely affect the use of commercial freight carriers (air and motor) because faulty information could improperly indicate a carrier's true performance. If shipment data indicate late deliveries, the Traffic Management Office may request a period of probation or non-use for that carrier.

Conclusions

Bottlenecks exist within the LRP Air Force-wide, based upon the supporting data from the ETADS. Over 80 percent of the 768 shipments evaluated did not meet the UMMIPS standard. When divided by theater of operation, bottlenecks exist within multiple segments of the pipeline. These segments are the AE (Item Availability) and AS (Shipment Status). The most prominent location is the AS segment with 49 shipments exceeding the UMMIPS standard by more than one day.

Based on careful evaluation of the processes, a significant factor resulting in bottlenecks is improper shipment planning. It is critical to verify information on the IRRD such as the SRAN/DoDAAC. If a shipment is misdirected it will result in a serious delay within the order-cycle and logistics pipeline and result in increased transportation costs.

Notes

1. Tucker, Scott, Master Sergeant, USAF, F-16 Two Level Maintenance (2LM) Lean Logistics Manager, Hill AFB UT, telephone interview, 13 Dec 96.
2. General Services Administration, *FedEx US Government Contract Services Guide*, Aug 96.

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